Hawaii in Space:

Building International Partnerships Across the Pacific

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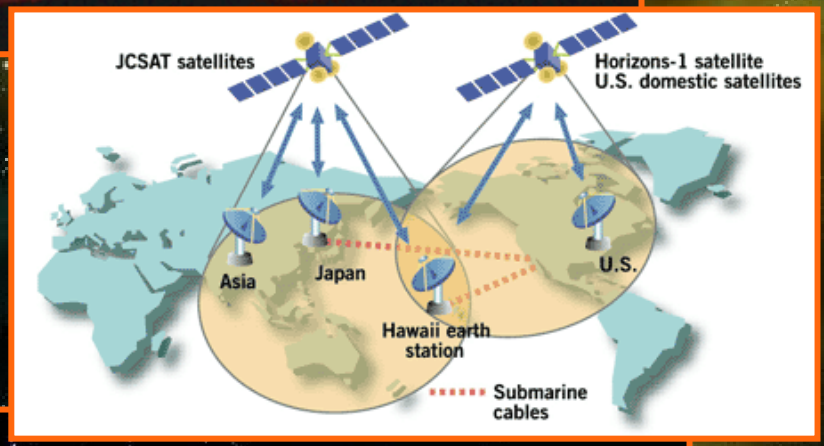
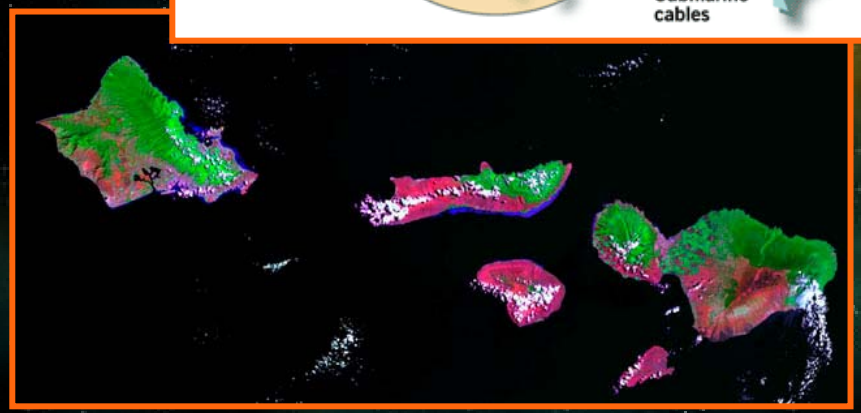
The Journey Begins…

- **Training for Apollo astronauts** on Mauna Kea, Mauna Loa and the Ka'u Desert.
- **Development of world-class astronomical facilities**, with investments of over $1 billion supporting 13 international observatories.

The Journey Begins…





- Pioneering achievements in **planetary geosciences**, advanced **satellite communications**, and space-based **remote sensing.**

The Journey Continues…

- Mauna Kea Science Reserve renown as world's **premier site for astronomy & astrophysics**, supporting groundbreaking studies of galaxy and star formation, interstellar matter, stellar evolution and cosmology.

- Science City on Maui supports **nation's largest space surveillance site**, with electro-optical sensors for tracking satellites, orbital debris, and astronomical objects.

The Journey Continues…

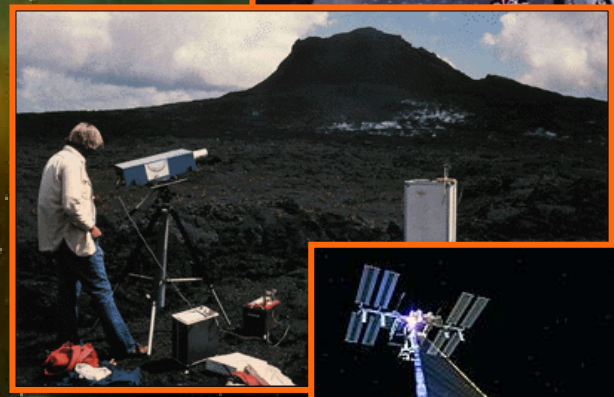
- University of Hawaii home to over 40 NASA PIs supporting **basic and applied research**, including development of new space-based technologies for ocean and environmental monitoring and studies of solar system objects from space.

- PMRF provides **world's largest multi-environment range** supporting surface, subsurface, air and space operations.

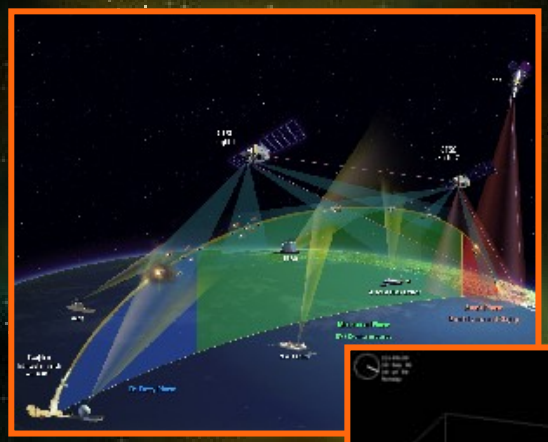
Looking to the Future…

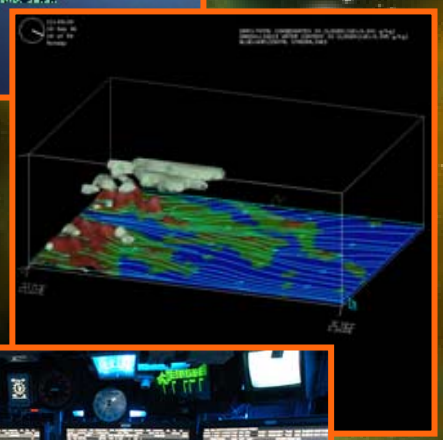
- The University of Hawaii is applying resident **expertise in adaptive optics, lidar/laser technology and remote sensing** to develop and commercialize **advanced sensor technologies** for:

  - astronomical research
  - atmospheric/oceanic monitoring, modeling and forecasting
  - terrestrial/coastal resource mapping
  - disaster management and mitigation



Looking to the Future…



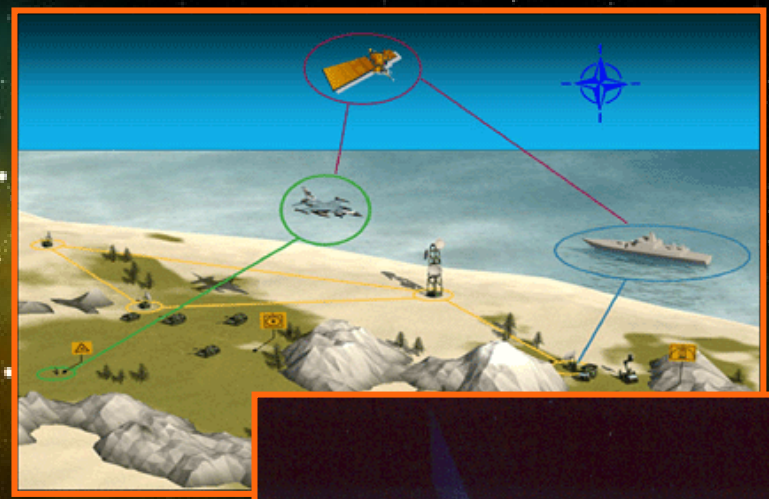


- Local companies working to develop **new commercial products and services** to support:
  - atmospheric monitoring and weather forecasting
  - land and coastal resource assessment
  - advanced air traffic control
  - air defense and military command & control systems
  - advanced optical communications and electro-optical tracking systems

Looking to the Future…

- Major aerospace corporations have the potential of **expanding operations in Hawaii as a bridge to Asia-Pacific markets**.

- Emphasis on the **development and delivery of advanced systems** for aviation maintenance and training, air traffic control, satellite communications, and space tracking, surveillance & reconnaissance.



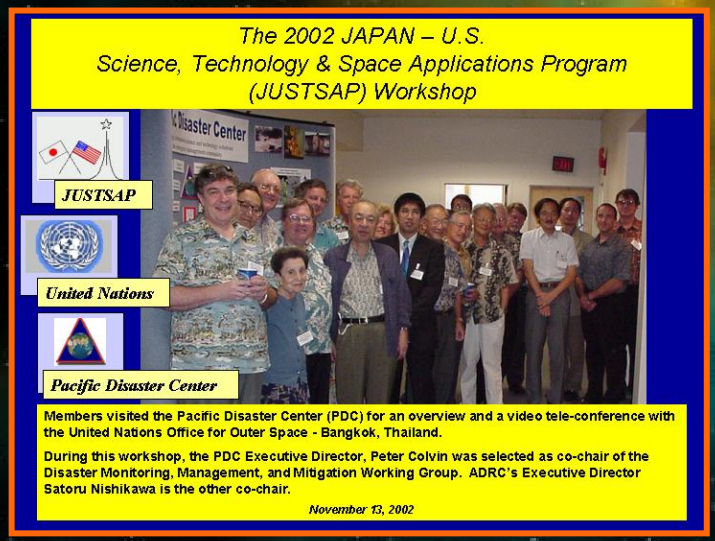
Looking to the Future…

- Mid-Pacific, near equatorial location and long-standing ties with nations throughout the Asia-Pacific region make Hawaii an **ideal location for commercial space launch activities** – including land, sea, and air-based operations.
- Only state in the nation from which **payloads may be launched into any orbit**, polar or equatorial, without overflying populated areas.
- University of Hawaii and several overseas companies currently pursuing **research and commercial launch options from Hawaii**.

JUSTSAP

Japan-U.S. Science, Technology & Space Applications Program

- A unique association of scientists, business executives, government officials, educators and students from Japan and the United States **promoting bilateral collaboration in the public and commercial use of space-related science and technology**.



- Project teams focus on the **design, development and implementation of advanced programs supporting robotic and human space exploration** (e.g., satellite communications, space-based remote sensing, space power systems, small satellite and launch infrastructure development).

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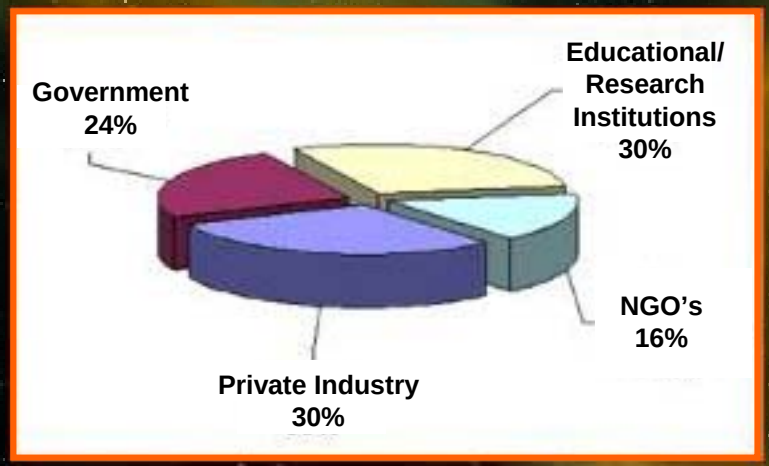
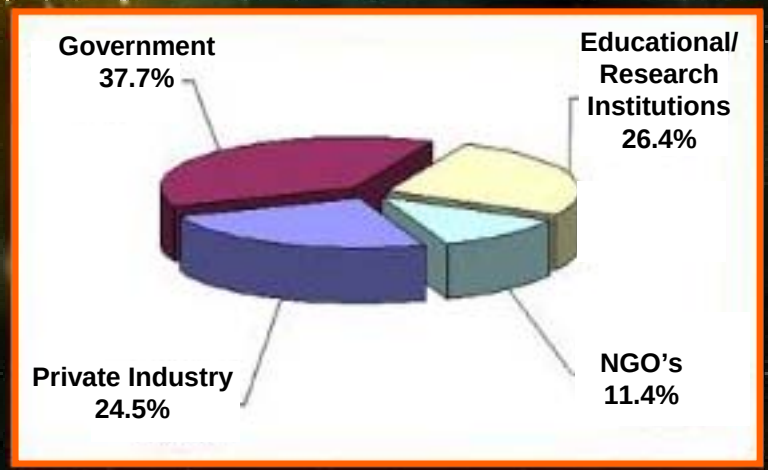
Institutional Representation





Delegate Affiliation

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Japan-U.S. Science, Technology & Space Applications Program

2006 JUSTSAP Sponsors/Associates

Alliance for Commercial Enterprises in Space
ARTEMIS Innovation Management Solutions, LLC
Auburn University
The Boeing Company
Center for Space Nuclear Research
Center for Space Power
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Consulate General of Japan - Hawaii
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Enterprise Honolulu
The Futures Channel
The George Washington University
Geohazards Consultants International
Hawaii Island Economic Development Board
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Institute for Unmanned Space Experiment Free Flyer (USEF)
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NASA Johnson Space Center
NASA Kennedy Space Center
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Tokyo Institute of Technology
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University of Hawaii
Institute for Unmanned Space Experiment Free Flyer (USEF)
Wood Associates

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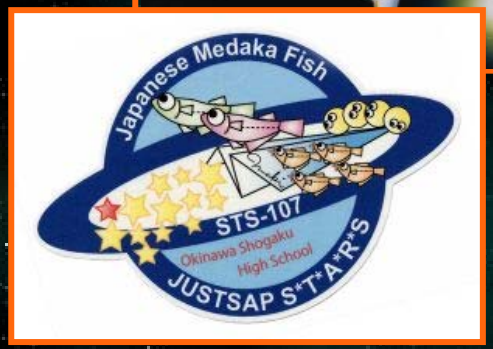

- Provided a **unique forum for dialogue and exchange** on multinational space research and policy.
- **Facilitated collaborative ventures** between Japan and the United States. For example:
  - Development/demonstration of **first trans-Pacific high data rate (155 mbps) seamless satellite-fiber optic communications bridge** between Japan and the U.S.
  - **Microgravity experiments** aboard the U.S. Space Shuttle to test the efficiency of manufacturing new products in a zero-G environment.
  - **Innovative data-base networking** to support collaborative disaster management protocols throughout the Asia-Pacific Region;
  - **University Space Systems Symposium** providing mentorship opportunities for the next generation of space scientists and entrepreneurs.

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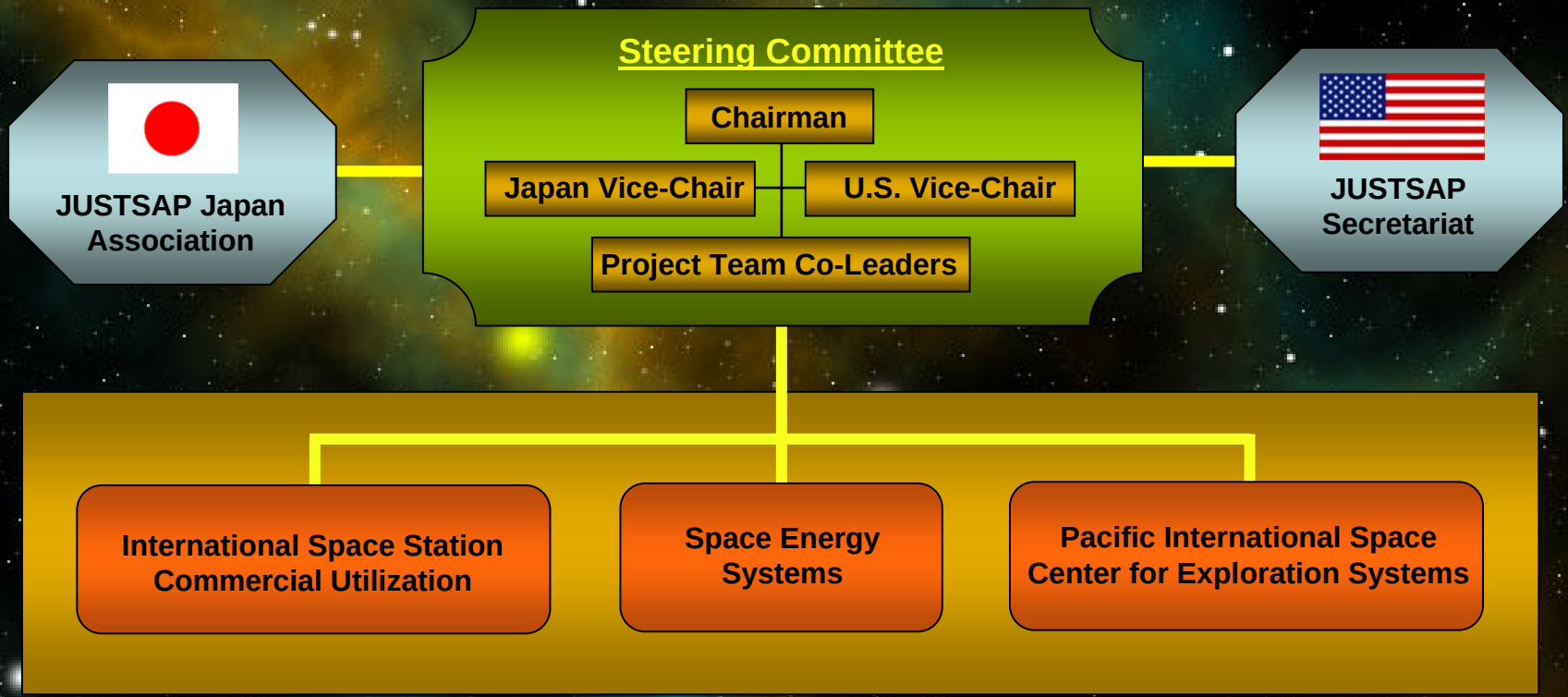
Current JUSTSAP Organization



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International Space Station Commercial Utilization (ISSCU)

- JUSTSAP, as an independent non-profit organization comprised of governmental, university and private sector representatives, is **well poised to identify/evaluate commercial options** for future management/operation of ISS.

- ISSCU Project Team will explore various commercialization options – e.g., a **'quasi government' corporation, owned by nation states in proportion to investment/usage**, with business structure for commercial development (e.g., COMSAT'/INTELSAT).

- Potential **long-term impacts on space commerce** (e.g., on biotech, energy production, pharmaceuticals, tourism) and as "staging post" for future space exploration.

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Space Energy System (SES)

- **Energy production a key component** for human settlement of our moon and beyond. and a critical resources for sustaining life on earth.

- SES Mission: to **generate new projects to advance energy production technology** (e.g., ISRU-enabled production of solar cells, power beaming; methodologies for producing He3 from the lunar regolith).

- SES projects **will utilize PISCES resources/infrastructure** provided by Pacific International Space Center for Exploration Systems currently under development by JUSTSAP and the State of Hawaii.

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Japan-U.S. Science, Technology & Space Applications Program

Pacific International Space Center for Exploration Systems *(PISCES)*

A Proposal by the Japan-U.S. Science, Technology and Space Applications Program (JUSTSAP) to Establish a Center for Astronaut Training, Aerospace Education, and Space Exploration Systems Development in the State of Hawaii

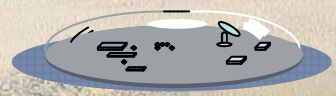
Pacific International Space Center for Exploration Systems (PISCES)

- PISCES is being designed as an **international center for aerospace education, astronaut training, and research and development of innovative space exploration systems** to support future robotic and human missions to our moon, Mars and beyond.

- A major goal of PISCES will be to **provide remote ground-based analog capabilities** to assist in the development, integration and testing of space exploration technologies.

The PISCES Vision

A simulated Lunar Outpost on the Big Island with support programs/facilities statewide



- **Located on lunar-like terrain on volcanic soils.**
- **Supporting research and development, pilot-scale testing, technology demonstrations, astronaut training, human and robotic capabilities, visitor experiences and public education for space exploration and settlement.**
- **Hosting Japan-U.S. collaborative projects sponsored by public and private sectors in both countries.**
- **Learning to live off the land in a hostile environment.**

Why Hawaii?

Location, Geology, People

- **Mid-Pacific location**
- **Unparalleled analog environment for lunar and Martian surface simulation**
- **International culture; ties with Asia-Pacific communities**
- **Strong and growing science and engineering at University of Hawaii at Manoa and Hilo**
- **Rapidly developing aerospace industry**

Geological Features

N

1 km

Varied Physical Environments

- Craters
- Deep Deposits of Volcanic Ash
- Underground Systems
- Long Distance Traverses

Facilities

General Features of PISCES

- Research Laboratories, Solar Power Systems (grid-independent), Rover Terrain, ISRU Pilot Plants, Life Support Systems, Habitats, Communications Networks, Classrooms, International Visitor Center.
- Staff for Operations, Support, Research and Instruction, with Visiting Scientists.
- Machine Shops, Electronics Shop, Rapid Prototyping, Spare Parts, Living Quarters.
- Accessible to Users and the General Public.

A Credible Scientific Attraction

Visitor Experiences

- **Immersion in the environment - it will look “lunar”.**
- **Analog lunar mission experience; a day at a lunar base.**
- **Real-time operations of complex systems (e.g. tele-operated rovers).**
- **Interaction with researchers; informed feedback.**
- **Special space education programs for all ages in space exploration and settlement, space technology, operations and safety.**

Goals of PISCES

- Provide **testbed for demonstration, evaluation and validation of technologies** (e.g., ISRU, robotics, habitats, surface operations, communications, remote sensing, imaging) to support future robotic and human missions to our moon, Mars, and beyond.
- **Train future scientists, engineers and other professionals** engaged in space exploration research.
- **Conduct in-field training programs for astronauts** from the United States, Japan, and other nations.

Goals of PISCES

- **Coordinate international meetings of space professionals** in Hawaii for design, development and implementation of space research programs (e.g., establishing a lunar observatory on the far side of the Moon).
- **Catalyze aerospace education programs** in local secondary schools, community colleges, and universities statewide.

Benefits of PISCES

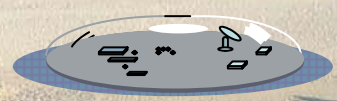
- **Isolated environments** for lunar/Martian habitat and operations simulations.
- **Dry and surface-hostile settings** for planetary surface research & demonstrations including:
  - High and low temperature range/extremes
  - Extra-fine lunar-simulant soils between volcanic peaks
  - Rugged terrain setup and sustained operational challenges
  - Advanced communications links (fiber and satellite)
  - Access to abundant energy and other natural resources

Benefits of PISCES

- Credible simulations will provide opportunities to **develop/ test/evaluate new technologies, standardize space sub-systems and interfaces, and promote greater reliability and safety** in systems and operations (critical, given the remoteness/isolation of space exploration environments).
- Responds to U.S. Public Law 109-155, sec. 504 (NASA authorization legislation) regarding **Ground Analog Facilities**, involving local populations and private sector partners.
- **Effective multinational linkage/coordination**, providing ideal venues for innovative multinational collaboration in space science, education, and exploration systems development.

PISCES Development

- **State will coordinate fundraising effort** to acquire land and build infrastructure during early years.



- **PISCES projected to be self-sufficient after five years,** with steady-state support from:
  - **Direct funding of proposals** through PISCES based on competitive selection in space research and technology development programs of interest to government and industry.
  - **Overhead returns** from participating universities, with user fees for unique costs, based on the needs of the users and their ability to pay.
  - PISCES **education and outreach programs**.

By Act of Hawaii State Legislature

Hawaii Concurrent (Senate/House) Resolution

"*Encouraging the Legislature, the Administration, the University of Hawaii, and Hawaii's congressional delegation to work collaboratively with the National Aeronautics and Space Administration, the Japan Aerospace Exploration Agency, and other public and private aerospace-related agencies and institutions, to expand and diversify the aerospace industry through the development of the Pacific International Space Center for Exploration Systems.*"

2006 JUSTSAP Symposium

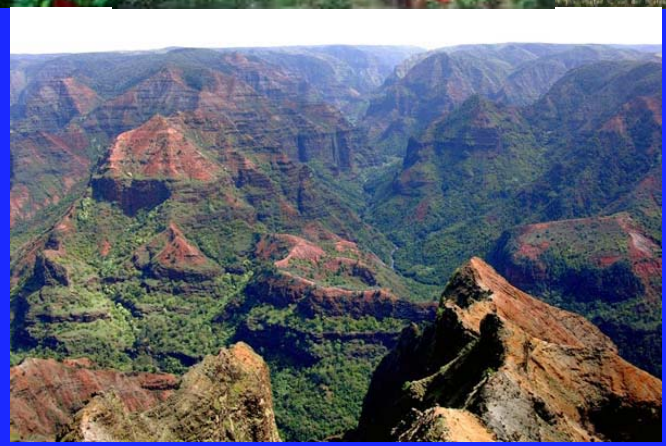
Hapuna Beach Prince Hotel - The “Big Island”

November 12-16

www.justsap.us

2007 JUSTSAP Symposium



The “Big Island” and Kauai

November 9-15

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Come explore the rainbows of opportunity
for Space Exploration in Hawaii nei…
Stepping Stones to the Stars!